Workshop #4: Inheritance

Learning Outcomes:

Upon successful completion of this workshop, you will have demonstrated the abilities to:

- Design and implement classes in the “is-a” relationship.
- Practice casting
- Describe to your instructor what you have learned in completing this workshop.

Requirements:

Part 1: [7 points]

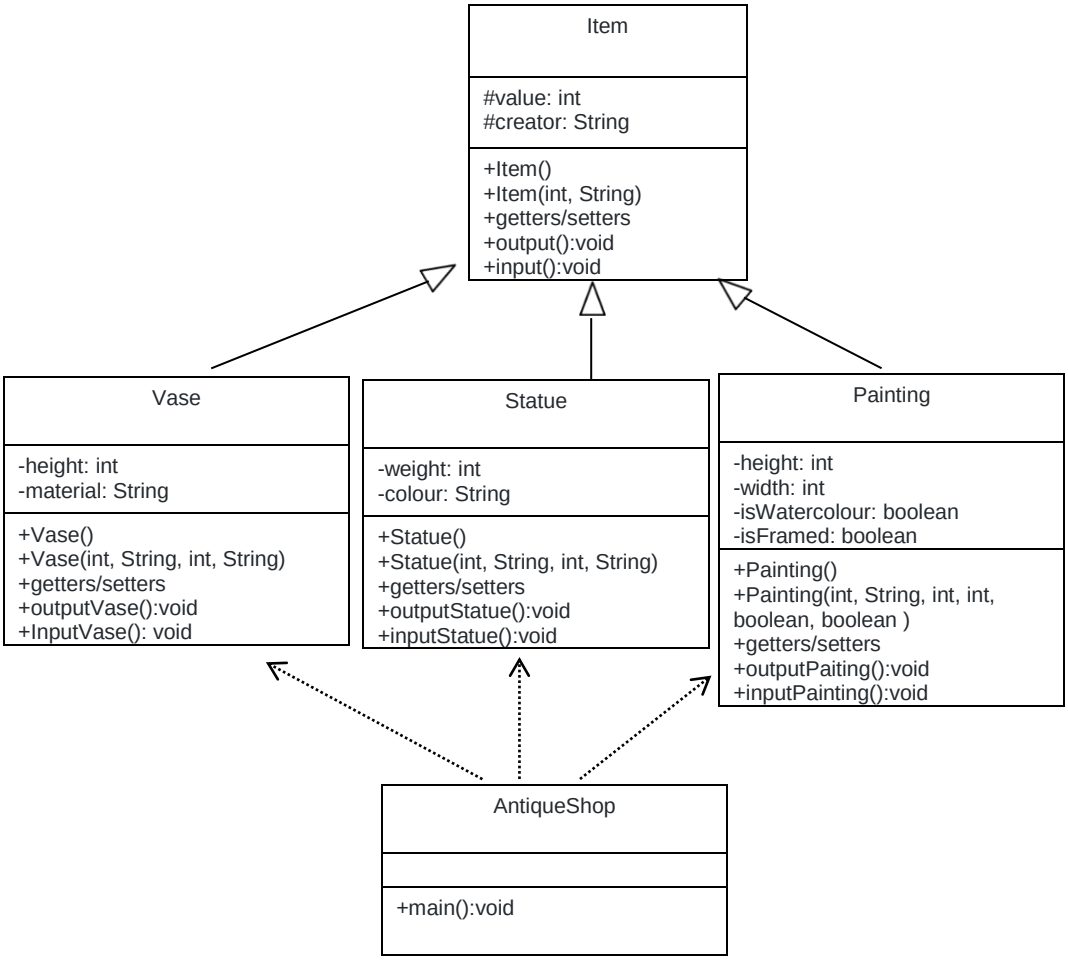
To complete this task you should read and study the lecture Inheritance

Step 1: Create a new project named “**ItemManager**”.

Step 2: Create a package named “**DTO**”, it contains some files: Item.java, Vase.java, Statue.java, and Painting.java

Step 3: Create another package named “**GUI**”, it contains the AntiqueShop.java file

Implement the class diagram as follows:



The AntiqueShop class is making use of Vase, Statue, and Painting, in the sense that it has declared references to them, and thus there is a dependency.

Requirement:

1. In the file Item.java,

    - The method input(): Using Scanner class to input all fields of the Item class. Verify: value>0, creator is not empty
    - The method output(): print out all fields

2. In the file Vase.java,
    - The method inputVase(): Using Scanner class to input all fields of the Vase class.
    - The method outputVase(): print out all fields of the Vase class

Hint:

```
public class Vase{
  …
 //this method is used to input all fileds of a vase object
 public void inputVase(){
    input();   // call the inherited method to input two fields: value, creator

    //TODO: you is required to add more your code to input two fields : height, material
    // use try..catch/throws to handle exceptions
 }

 //this method displays information of a vase object
 public void outputVase(){
    output(); // call the inherited method to print two fields out: value, creator
    System.out.println("Height:" + height);
    System.out.println("Material:"+ material);
 }
  …
}
```

3. You do the same for Statue class, Painting class
4. In the file "AntiqueShop.java". you type like as follow:

```
public class AntiqueShop {

  public static void main(String[] args){
    Item item=null;
    int choice=0;
      Scanner sc=….
    do{

        System.out.println("1. Create a Vase:");
        System.out.println("2. Create a Statue:");
        System.out.println("3. Create a Painting:");
        System.out.println("4. Display the Item:");
        System.out.println("Input a choice:");
        Choice=sc.nextInt();
        switch(choice){
                case 1:
                        item=new Vase();
                                ((Vase)item).inputVase();
                                break;
                    case 2:
                            item =new Statue();
                             ((Statue) item).inputStatue();
                       break;
                    case 3:
                            item =new Painting();
                            ((Painting) item).inputPainting();
                       break;
                    case 4:
                            if(item!=null){
                                if(item instanceof Vase)
                                        ((Vase) item).outputVase();
                                   else if(item instanceof Statue)
                                        ((Statue) item).outputStatue ();
                                   else if(item instanceof Painting)
                                        ((Painting) item).outputPainting ();
                                }
                               else System.out.println(" you need to create an object");
                         break;
        }

      }while(choice<=4);  }
```

5. (Optional) Now, you is required to update the above program. You should create a new class named **Menu**. This class contains one static method

```
//use this method to show pre-defined options
//input: an array contains the list of options
//output: return a user's choice that is inputted from the keyboard.
public static int getChoice(Object[] options){
    for (int i=0; i<options.length; i++){
        System.out.println((i+1) + "-" + options[i]);
    }
    System.out.print("Choose 1.." + options.length + ": ");
    Scanner sc = new Scanner(System.in);
    return Integer.parseInt(sc.nextLine());
}
```

⇨ Update the main method to use the Menu class.

```
public class AntiqueShop {

  public static void main(String[] args){
    String[] options={" Create a Vase ","Create a Statue"," Create a Statue"," display the item"};
    Item item=null;
    int choice=0;
    do{

        choice=Menu.getChoice(options);
        switch(choice){
                case 1:
                        item=new Vase();
                        ((Vase)item).inputVase();
                        break;
                ....
     }while(…);
}
```

Part 2: Draw the memory map when the program runs [3 points]

Explain step by step what happened when the program runs and answer some questions.

- What is stored in the static heap, stack, dynamic heap?
- What are objects in the program?
- What is the item variable storing?
- Why must you cast to call the method inputVase()/outputVase()?
- What is the error thrown when you cast it wrong?
- What methods can you call if you don't cast the item variable?